commodore 64

EASY PROGRAMMING PROJECTS FOR BEGINNERS

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FOREWARD

Although this booklet is for beginners, it does assume that the person has already had some lessons and is familiar with the keyboard. This is not a BASIC tutorial. It is a collection of easy sample programs for a beginner to pursue in addition to the regular classroom lessons.

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COMPUTER ANIMATION

COMPUTER ANIMATION refers to a programming technique in which an image appears to move about the screen. A LOOP (a series of repeated steps) is often used to present the viewer with several different FRAMES in rapid succession, much like a movie.

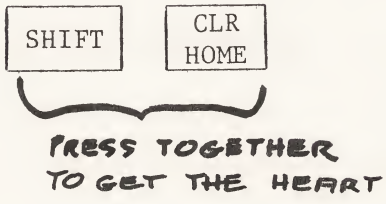
THE DELIVERY TRUCK

This program uses keyboard characters to represent a delivery truck moving across the screen. The TAB(X) section keeps the image together and it is important that the quotation marks be directly underneath each other as shown in the sample program. Line numbers must also be of equal length to prevent distortion of the image.

```
100 FOR X = 1 TO 30
120 ?:?:?:?:?:?:?:?:?
130 PRINT TAB(X)"    ***     "
140 PRINT TAB(X)"****    *   "
150 PRINT TAB(X)"********    "
160 PRINT TAB(X)" @    @     "
170 PRINT "♡"
180 NEXT X
```

In most computers, a question mark is an abbreviation for the PRINT command.

Clear the screen.



NOTE: If your computer has graphics characters, use them to create a better image of a truck.

THE FALLING METEOR

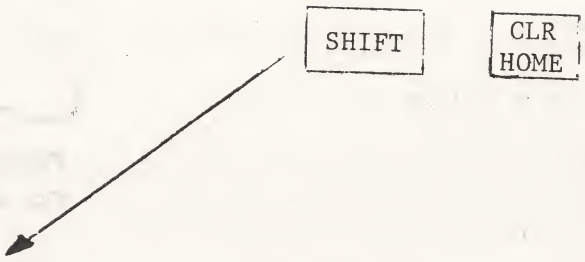
This program combines a knowledge of mathematical graphics and the concept of a meteor falling towards earth. The meteor is represented by an asterisk "*", but can be modified to suit the programmer's needs by changing the symbol within the quotation marks. Earth is shown as a dotted line in this example.

```
100 FOR X = 1 TO 15  STEP .3
120 F = SIN(X) + COS(X)
130 F = 5 * F + 15
140 PRINT TAB(F) "*"
150 NEXT X
160 PRINT TAB(14)"@#@";TAB(25)"CRASH!"
170 PRINT TAB(14)"///"
180 PRINT"------------$&@#-----------------"
```

Character used to represent the meteor.

An interesting variation of this program would be to have the meteor dig a hole in the ground when it lands.

Animated Rocket




```
100 PRINT " [V] "
110 ? : ? : ? : ? : ? : ? : ? : ?
120 FOR A = 1 TO 3
130 PRINT TAB(15) " * "
140 PRINT TAB(15) "***"
150 PRINT TAB(15) "* *"
160 PRINT TAB(15) "* *"
170 PRINT TAB(15) "* *"
180 PRINT TAB(15) "***"
190 PRINT TAB(15) "* *"
200 FOR C = 1 TO 30
210 ?
220 NEXT C
230 NEXT A
240 PRINT TAB(8) "HOUSTON, ALL SYSTEMS GO."
250 PRINT TAB(8) "JUPITER HERE WE COME!"
260 ? : ? : ? : ? : ? : ? : ? : ?
270 END
```

Waving Graphics Program

```
10 REM WAVING GRAPHICS PROGRAM
20 PRINT " [♡] "
30 FOR X = 0 TO 6.6 STEP .3
40 Y = SIN(X)
50 Y = Y * 15 + 15
60 PRINT TAB(Y) "                    "
70 NEXT X
80 END
```

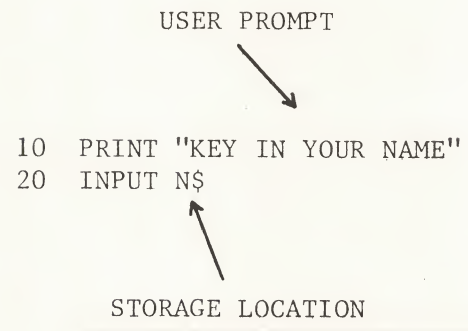
PRESS TOGETHER TO GET HEART.

INSERT YOUR NAME

INTERACTIVE PROGRAMMING

INTERACTIVE PROGRAMMING refers to a programming technique which allows the user to key information into the computer while the program is operating. The messages which appear on the screen during the program are called USER PROMPTS because they "prompt" the person.

INTERACTIVE PROGRAMMING



When the instruction KEY IN YOUR NAME appears on the screen, the person at the keyboard will respond by typing in his/her name. The name is then stored in a storage location called N$ for

Words require a $ sign with the storage location, but numbers do not. For example ...

EXAMPLE:

```
10  PRINT "KEY IN YOUR NAME"
20  INPUT N$
30  PRINT "♡QQQQQQQQQ"

40  PRINT TAB(10)"HELLO ";N$
50  PRINT TAB(10)"NICE TO MEET YOU."
```

After typing in this program, ask someone near you to run it. Interactive programs are used by someone other than the original programmer.

THE GREETING

```
10  REM  THE GREETING
20  PRINT " [♡][Q][Q][Q][Q][Q][Q][Q][Q] "
30  PRINT TAB(8) "KEY IN YOUR FIRST NAME"
40  ?
50  PRINT TAB(15):INPUT N$
60  PRINT " [♡][Q][Q][Q][Q][Q][Q][Q][Q] "
70  PRINT TAB(9) "HELLO ";N$;" YOU SEEM"
80  PRINT TAB(9) "TO LEARN PROGRAMMING"
90  PRINT TAB(9) "VERY QUICKLY."
100 ?:?:?
110 PRINT TAB(10) "CONGRATULATIONS!"
120 END
```

YOUR TURN: Type in NEW and press the return key. Press SHIFT and CLR/HOME to clear the screen.

Design a program which will ask a person's age, clear the screen, then print the message ...

YOU LOOK VERY DISTINGUISHED FOR A PERSON WHO IS _____ YEARS OLD.

WORK SHEET TO PLAN YOUR PROGRAM

LINE NUMBERS	INSTRUCTIONS
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____

GREATER SCREEN CONTROL

Greater screen control can be achieved by horizontally and vertically centring information. In addition, TIMER LOOPS can be used to present information for certain lengths of time on the screen before going on with another frame of information.

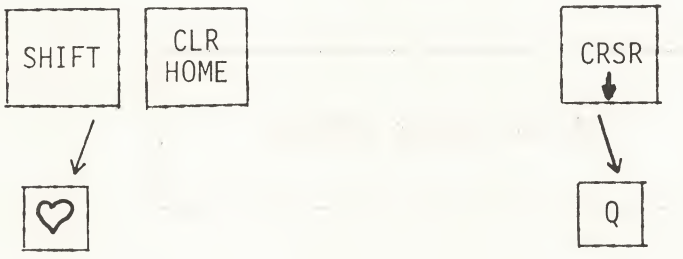
CENTRING A MESSAGE

LESSON: A message can be centred vertically and horizontally on the screen for better viewing. All good programs contain this feature.

EXAMPLE:

10 PRINT "♡QQQQQQQQQQ"

20 PRINT TAB(8)"THIS LINE IS CENTRED!"



Notice that the heart is a combination of the SHIFT and CLR/HOME keys.

The letter Q is actually the down cursor key.

YOUR TURN: Type in NEW. RETURN. Press shift and CLR/HOME to clear the screen.

Design a program which will print these phrases in the centre of the screen.

"THIS IS A GOOD BEGINNING"

"I CERTAINLY LEARN QUICKLY!"

WORK SHEET TO PLAN YOUR PROGRAM

LINE NUMBERS	INSTRUCTIONS
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____

TIMER LOOPS

LESSON: A timer loop is a one line statement in a program which makes the computer appear as if it has stopped. Actually, it's busy counting!

Timer loops are helpful if you wish to leave a set of instructions on the screen just long enough for the average reader, before going on to something else.

EXAMPLE:

```
10 PRINT "♡QQQQQQQQQQ"
20 PRINT TAB(10)"THIS MESSAGE WILL"
30 PRINT TAB(10)"APPEAR FOR SEVERAL"
40 PRINT TAB(10)"SECONDS. THEN LIKE"
50 PRINT TAB(10)"MAGIC, DISAPPEAR!"
60 FOR C = 1 TO 3000 : NEXT C
70 PRINT "♡"
80 END
```

TIMER LOOP ⟶ line 60

YOUR TURN: Type in NEW. RETURN Press SHIFT and CLR/HOME to clear the screen.

Design a program which will leave this message on the screen for several seconds, then disappear.

Insert your name

```
"_____, YOU'RE A"
"REALLY GREAT PERSON."
"I'M GLAD YOU'RE HERE!"
```

Creating Pauses in Programs

Often, programmers need to have a method of displaying information on the screen for a specified length of time, long enough that people can read it, before it is replaced with new information. Because the pause in the program can be created with a *for...next* loop. it is referred to a **timer loop**. Consider the following timer loop.

```
50   FOR N = 1 TO 500
60   NEXT N
```

This causes a pause in the program of about six seconds. When the timer loop is completed, the computer continues on with the rest of the program. A colon (:) will allow us to connect two statements into one long one. The timer loop shown above can then be written as

```
50   FOR N = 1 TO 500 : NEXT N
```

The length of the pause is determined by the speed at which the microprocessor chip operates. Each manufacturer has its own computer chip. Some computer chips are more efficient, and therefore faster, than others. As a general guideline, the following number of loops will create these approximate pauses in the program.

TIMER LOOP CHART

Number of Loops	Program Delay in Seconds
1000	1.5
2000	3.0
5000	7.5
8000	12.0

WORK SHEET TO PLAN YOUR PROGRAM

LINE NUMBERS	INSTRUCTIONS
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____
____	_____

TEST YOURSELF

HOW MUCH HAVE YOU LEARNED?

1. All the electrical and mechanical parts of a computer system are generally referred to as ...

   (a) firmware
   (b) courseware
   (c) software
   (d) hardware

2. The instructions which make a computer operate in some required manner are generally referred to as ...

   (a) output
   (b) cathode ray tube
   (c) software
   (d) hardware

3. When an answer from a computer appears on a printed page, it is called a ...

   (a) readout
   (b) printout
   (c) device
   (d) input

4. If a program that works on an Apple will not run on a Commodore, the reason might be that ...

   (a) the version of BASIC is different
   (b) the diskette is read differently
   (c) some commands are not recognized by the other computer
   (d) all of the above
   (e) none of the above

5. To program a computer to clear the screen, the appropriate command would be ...

COMMODORE	APPLE
(a) PRINT [♡]	(a) PRINT "HOME"
(b) PRINT "[♡]"	(b) HOME
(c) CLS	(c) CLS
(d) CLEAR	(d) CLEAR

GLOSSARY

Many of these definitions are from *The Penguin Dictionary of Microprocessors*, by Anthony Chandor, Penguin Reference Books, 1981. Copyright © Anthony Chandor, 1981. They are reprinted by permission of the author and Penguin Books Ltd.

Acoustic coupler
A device capable of transmitting and receiving audio tones which can be sent on telephone lines, allowing a *modem* to be linked to a telephone handset.

Address
An identification by a name, label, or tag of a storage location or other source or destination of data.

Analog
Pertaining to a device that represents and measures numerical quantities by means of continuous physical variables such as, for example, currents, voltages, mechanical gears.

Array
An orderly arrangement of items of data, so constructed that the relative position of an element of an array has a relevance to the operation to be performed on that element.

ASCII
Acronym for American Standard Code for Information Interchange. A standard code which assigns specific *bit patterns* to the signs, symbols, letters, numbers, and operations of a specific set.

Assembler
A program which translates a *symbolic-language* program into a *machine-language* program.

Authoring language
A high-level language program that enables those not skilled in programming to write programs easily, e.g., PILOT.

BASIC
An acronym for Beginner's All-purpose Symbolic Instruction Code. A high-level language designed for developing programs in a conversational mode. Popularly used with microcomputers.

Batch
A group of transactions collected for processing as a single unit.

Bit
A contraction of binary digit. One of the two characters (0 and 1) used in binary notation.

Branch
To select, as a result of a decision, one of a number of sets of instructions in a program.

Bug
Any defect or malfunction of a computer, program, or system. The process of exterminating them is called *debugging*.

Bulletin board
A computer system capable of receiving messages from a user connected via a communications line, holding them in storage, and displaying them on request by sending them to another user over a communications line.

Byte
A group of adjacent binary digits (usually eight) operated on as a unit; usually a subdivision of a word.

CAI
Acronym for Computer-Assisted Instruction. CAI appears most often as a general term for the use of computers in teaching. Some authors use the term CBE (Computer-Based Education) generally to describe the educational use of computers. They reserve CAI for cases in which computers provide instruction and CAL (Computer-Aided Learning) for computer activities that support other types of instruction or develop problem-solving skills. As yet, there are no universally applied definitions for these and other similar terms.

Carrier
The signal that is continuously present on a communications line and can be modulated for the representation of data.

Cathode-ray tube (CRT)
A device consisting of a vacuum tube, a display screen, and a beam of electrons controlled and directed by deflection. The device may be used as a display or a storage device or both.

Chip
A single device consisting of transistors, diodes, and other components forming a complex circuit on a section of a wafer sliced from a crystal of silicon.

COBOL
The word is derived from COmmon Business Oriented Language. A high-level language designed to allow the expression of data manipulation and business data processing problems in a form of recognizable English.

Command
An instruction that causes a computer to carry out an operation. Commands are usually given directly by a user; when placed within a program they are called *statements*.

Compiler
A program that prepares a *machine-language* program from instructions written in a *source language*. A single source-language statement often causes many machine-language instructions to be created.

CPU
Central Processing Unit. The "clever" part of a computer that receives the instructions, makes the decisions, and does the arithmetic. It usually manages the rest of the computer.

Cursor
A screen character in a terminal display which indicates the location of the next character to be generated.

Data
Any group of information elements made up of numbers, alphabetic characters, or symbols denoting any condition, value, or state.

Data bank
A collection of *files* of *data* that may be available to many users,

usually by means of remote terminals. An implication of a data bank is that widely diverse uses are made of the data.

Database
A collection of related files of data structured to allow a number of *applications* to access the data and update it without dictating or constraining the overall file design or content.

Disk (magnetic)
A *storage device* consisting of one or more flat, circular, magnetically coated plates, on the surface of which data is stored in the form of magnetic spots arranged as binary data.

Disk drive
The transport mechanism of a magnetic disk unit causing the movement of the magnetic medium.

Documentation
The process of collecting, organizing, and presenting information relating to a computer system; documentation is necessary to provide a source of reference for all manual and automatic procedures forming part of that system.

Dot matrix printer
A *printer* in which each character is made up of a matrix of dots formed by wires, styluses, or jets.

Drill and practice program
A computer program in education that drills concepts already taught.

Emulation
A program which causes a computer to behave so as to imitate the behavior of another machine.

Feasibility study
Initial research into the suitability and capability of possible solutions to a problem, usually resulting in estimates of time scales, costs, and benefits of an outline solution.

Field
A specified part of a *record*, containing a unit of information; for example, a personnel record might contain fields for personnel number, name, job title, age, date of joining, gross pay.

Floppy disk
A magnetic disk made using a flexible base material; relatively inexpensive. (See Disk [magnetic].)

FORTRAN
An acronym for FORmula TRANslation. A high-level language for scientific and mathematical use, written in a combination of algebraic formulas and English statements in a readable form.

Gate
An electronic switch, used in electronics to refer to any circuit that may have more than one input signal but only one output signal.

Hard copy
A document produced in a tangible form suitable for human beings to read; usually, a printed paper output.

Hardware
The physical units making up a computer system — the apparatus as opposed to the programs.

Immediate execution mode
When the computer immediately performs the commands we give it.

Interpreter
A program that translates *source-language* instructions into *machine-code* instructions during the operation of the program. The source-language instructions are translated by subroutines into machine-code instructions, which are then immediately executed.

Joystick
An input device with a lever attached that controls the movement of a cursor or other display element.

Key
An identifier — alphabetic or numeric — used to locate a record within a file.

Logo
A version of LISP, a list-processing language, employing *turtle graphics* and used in education to teach problem solving and logic concepts.

Machine language
The set of instructions that can be used by the machine, and which represents the instruction repertoire of a computer.

Mainframe computers
Refers to large computers, distinguishing them from *microcomputers* and *minicomputers*.

Memory
A device or a series of devices capable of storing information temporarily or permanently in the form of patterns of binary ones and zeros. The computer then reads information from the memory or writes information into it when it operates.

Microprocessor
A central processor, capable of arithmetic, logic, and program control, contained on a single chip.

Modem
Acronym for modulator/demodulator. A device that allows data to be transmitted over telephone circuits.

Modulate
To change information so that it is *carried* at a particular frequency, usually to allow transmission over a distance.

Nanosecond
One thousand millionth of a second. The unit of time used to measure electronic events within a computer.

Object program
The final translated version of a program, ready to run on the computer.

Operating system
The basic software that supervises and controls the running of other (user-oriented) programs.

Packet switching
Data transmission storing and forwarding messages which have been broken up into "blocks" or *packets*. The *channel* is occupied only during the short time a packet is being transmitted.

Parallel transmission
The transmission of all the bits of a character at the same time.

PILOT
An *authoring language* for developing and running computer teaching programs. It requires only elementary computer skills on the part of the user.

Pixel
A picture element of a terminal screen. The smallest part of the screen that can be individually illuminated.

Process control
The use of a computer to directly control a physical process. Often used to describe a computer that "senses" physical processes.

Program
A set of instructions prepared to provide a computer solution to a problem, by directing a computer to carry out a desired sequence of operations.

RAM
Acronym for Random Access Memory. It provides access to any location, allowing data to be written to or read from any location. Volatile.

Raster
The coordinate grid of a *terminal screen*, dividing the display area into discrete positions.

Raster graphics
A method of computer graphics production in which the electron beam sweeps the screen in a fixed pattern, illuminating parts of the screen. The manner in which a TV screen is scanned to produce a picture.

Read/write head
An electromagnet used to read from or write to a magnetic medium.

Record
A data processing unit holding information about a transaction or object, made up of a group of related fields.

Robot
A device capable of controlled movement; usually a computer that is able to move or manipulate objects according to sensed information.

ROM
Acronym for Read Only Memory. A memory circuit in which the stored pattern is written during manufacture and cannot be changed by the user or altered by a program. Nonvolatile.

Scroll
To move the contents of the screen up or down, a line at a time.

Serial transmission
The transmission of the bits of a character sequentially.

Simulation
A program that imitates a physical situation, thereby providing experience not easily gained otherwise.

Software
All programs written to be executed on hardware. Usually refers to major programs.

Software compatible
Pertaining to a computer that can accept and run programs written for another specific computer.

Source code
A program in a language written by a programmer; the source code cannot be directly executed, but must first be compiled into object code.

Spread sheet
A business planning and analysis tool that allows information to be laid out in columns and rows. It is useful for historical analysis and planning forecasts.

Statement
Another name for an instruction used as part of a computer program.

Systems analysis
The investigation and recording of existing systems and the design of new systems.

Tape drive
A device for controlling the handling of *magnetic tape*: consists of a transport mechanism which drives the tape past a read/write head and allows automatic rewinding.

Time sharing
A method of allowing one device to be used for two or more concurrent operations, e.g., several terminal devices using the input, processing, and output facilities of a central processor apparently simultaneously.

Truth table
A mathematical table which shows the Boolean relationship of variables, demonstrating the results obtainable from various combinations of values.

Turtle graphics
A manner of drawing in which a drawing *cursor*, called a *turtle*, is directed to travel in a certain manner left, right, forward so as to produce a geometrical shape.

Tutorial
A computer program that teaches and then drills concepts. It differs from a drill program in its *branching* capabilities, based on user input.

Vector graphics
A method of producing computer graphics in which the electron beam is sent directly to the place on the screen where the object is to be drawn.

Videodisk
A disk holding a large amount of pre-stored information, which may be read in an appropriate playback device primarily used for playing back video pictures.